The Distributed Visible Human Explorer

Hao Le[1] and Brian Wannamaker[2]

[1]Flashback Imaging, Thornhill, Ontario, Canada,
[2]Brian Wannamaker, Sea Scan International, Caledon East, Ontario, Canada
E-mail: haole@flashbackimaging.com

ABSTRACT

The Visible Human Explorer from Flashback Imaging is an innovative approach to fast and interactive access to the full image dataset of the Visible Man and Visible Woman. It is available in many forms and sizes, ranging from a simple CD-based system to a full-scale 30-gigabyte version. In the last few years, the stand-alone exhibit version with 30,000 images derived from the Visible Human Project has been installed in a number of large science centres and museums in Canada and the USA. We believe that the next logical step after public viewing would be distributing. A distributed version of the Visible Human Explorer, with the same capability as the exhibit version while having more functionality, would promote and accelerate further usage of the Visible Human datasets.

In this paper, we describe the experience of working with the distributed version of the Visible Human Explorer. A work-group, collaborative scheme for labeling and segmenting the complete Visible Woman dataset will also be discussed. The approach is to provide a customized software toolkit that allows widely distributed experts to quickly and easily annotate individual slices while almost immediately verifying annotations and changes with their colleagues over a wide area network. Using a combination of local and remote storage devices, the same collaboration can be extended to the entire network of the Internet. This ultimately allows greater international collaboration and quicker access and distribution of the information. Such a system is also suitable as a Next Generation Internet (NGI) application.

KEYWORDS

Animation, Collaboration, Distributing, Next Generation Internet, Wide Area Network.

INTRODUCTION

The Visible Human Explorer from Flashback Imaging is an innovative approach to fast and interactive access to the full image dataset of the Visible Man and Visible Woman (RSNA'96 InfoRad). It incorporates reconstructed coronal and sagittal views and is targeted for economical personal computer platforms. The Visible Human Explorer is available in many forms and sizes, ranging from a simple CD-based system to a full-scale 30-gigabyte version. In the last few years, the stand-alone exhibit version with 30,000 images derived from the Visible Human Project has been installed in a number of large science centres and museums in Canada and the USA. The visitors to these exhibits freely roam through the male or female body, interactively browsing 30,000 high-resolution full color anatomical images.

While the Visible Human Explorer exhibits have allowed millions of children and adults to learn a great deal about the Visible Human Project, the lack of high quality segmented and labeled datasets, in particular for the Visible Woman, has been an obstacle to further educate the public. One way to speed up the segmentation and labeling of the Visible Woman dataset is to come up with a system that allows large-scale collaboration among anatomists and related personnel who will share the workload of this enormous task. Starting with a simple Local Area Network with the goal to expand to the World Wide Web, Flashback Imaging is attempting to derive a distributed version of the Visible Human Explorer that helps achieve this objective.

METHOD

While the networked version allows multiple accesses to the same dataset, the objective of the Distributed Visible Human Explorer is not just data sharing. The plan is to form a work-group, collaborative scheme for labeling and segmenting the data, in particular the complete Visible Woman

dataset. The approach is to provide a customized software toolkit that allows widely distributed experts to quickly and easily annotate individual slices while almost immediately verifying annotations and changes with their colleagues over a wide area network. With the scalable client/server architecture, many more specialists can join the team and be part of an integrated process at any time. The customized interface based on the Visible Human Explorer engine increases efficiency and quality control. Using a combination of local and remote storage devices, the same collaboration can be extended to the entire network of the Internet. This ultimately allows greater international collaboration and quicker access and distribution of the information content inherent in the Visible Human dataset.

RESULTS

In the first phase of the project, we placed the standard 30,000 image set used in exhibition on an NT server connected to a local area network of a few thousand nodes (mixed between 10BaseT and 100BaseT). The network-enabled Visible Human Explorer software is also installed on the same PC. From any other PC over the network, access to the complete Visible Human database is done by simply pointing and clicking at the executable file located on the server. No installation is needed from any client PC. This setup forms the most basic version of the Distributed Visible Human Explorer.

The Visible Human Explorer based on this client/server model allows the entire digital library of the Visible Human data, including the reconstructed coronal and sagittal data, to be stored at a single central location. The software permits interactive access to the full image datasets from remote locations networked to the central site. It allows sharing of the datasets among multiple users while offering similar speed and interactivity as the single user, stand-alone system. Recently, this distributed version has been installed in the Samsung Medical Center in Seoul and the SungKyunKwan University in Suwon, Korea. The installation was done on the regular fast Ethernet networks with a few thousand nodes each. Initial results indicate that the browsing speed of the images ranges from excellent to reasonably good during low traffic time, and less than desirable when the traffic is heavy. In this early model, images are moving across the network in non-compressed mode, which places heavy load on the system. We are studying several compression technologies that allow image size reduction between 10 times and 30 times. Current tests indicate that speed improvement is between 2 times (in low-traffic time) to 10 times (in high-traffic time).

CONCLUSIONS

As we are working toward our goal of completing the work-group system, we realize that the same system should also serves as a model for installation on faster networks such as the Gigabit network and the Next Generation Internet. High-quality images could be moved quickly across the Internet which would further enhance the experience with interactivity.

The core software engine used in the Visible Human Explorer is suitable for any similar tasks and can be used as an interactive search engine for other large databases (e.g., remote sensing) with an appropriate user interface. Since the capability of the engine is virtually independent of the database size, this approach is ready for the future challenge of increasingly large data volumes.

The technologies are designed to solve the basic problem of information accessing: "too much information, too little time". Future web-based applications based on the same technologies will further the goal and has the potential of changing the way that most users search information over the web. In this paper, we will describe the experience of working with the distributed version of the Visible Human the Visible Human dataset.

REFERENCES

1. Ackerman M. J., The Visible Human Project, Proceedings of the IEEE, March 1998, Vol. 86, No. 3, pp. 504-511.

2. Le H., B. Wannamaker, D. Mikulis, A Fly-Through of the Human Body, The Visible Human Project Conference, Oct. 7-8, 1996, pp. 31-32.

3. Le H., B. Wannamaker, Practical Applications of the Visible Human Explorer, The Second Visible Human Project Conference, Oct. 1-2, 1998, pp. 49-50.
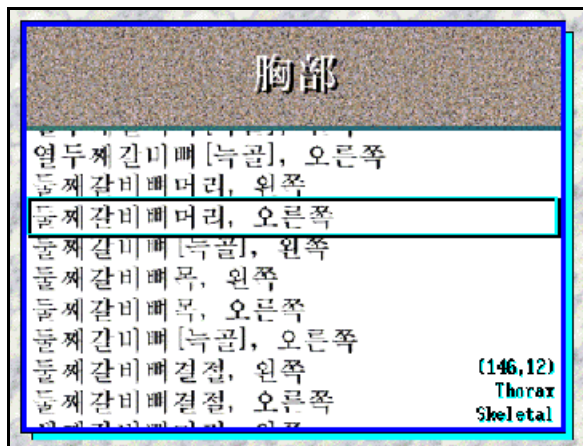
Figures 1. A portion of the main screen showing selection of anatomical structure (in Korean) - part of the distributed Visible Human Explorer installed in the Samsung Medical Center in Seoul and the SungKyunKwan University in Suwon, Korea..
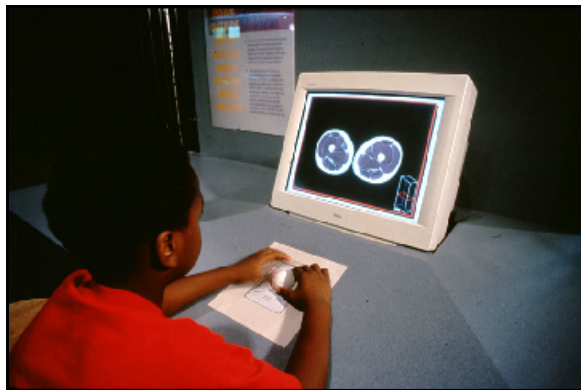
Figures 2. The Visible Human Explorer at the National Museum of Health and Medicine, Washington DC, USA (Human Body Human Being).

Figures 3. The Visible Human Explorer at the Maryland Science Center, Baltimore, MD, USA (Women's Health Project).

Figures 4. The Visible Human Explorer at the National Museum of Science and Technology, Ottawa, Ontario, Canada.

Figure 5. The Visible Human Explorer as part of The Human Body exhibit in the Ontario Science Centre (Toronto, Ontario, Canada).